

INTERACTIVE SYMPTOMATIC RECORDING SYSTEM AND METHOD
UTILIZING SYMPTOMATIC MEMORY

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation in part of copending U.S. patent
5 application Serial No. 09/122,404 filed July 25 1998 and of copending U.S.
Patent application Serial No. 09/880,973 filed June 14,2001, which patent
application Serial No. 09/880,973 is a continuation of application Serial No.
09/122,404.

BACKGROUND OF THE INVENTION

10 Field of the Invention:

This invention relates to interactive computerized systems and methods
for obtaining and processing information. More particularly, the invention
pertains to an interactive system and method for receiving information
regarding a customer, equipment such as an automobile, a tractor and/or
15 trailer, a fork lift, cherry picker or front loader, and symptomatic problems
that prompt the need for service or repair of the equipment, and the
processing of the symptomatic information to generate equipment work and
parts orders for the customer, for parts suppliers, and for service personnel.
The invention further pertains to the transmission of work completion data to
20 accounting and/or quality control subsystems. While the invention is usable
for servicing a variety of equipment, it will be primarily described here in
terms of automobiles because the description of this example addresses most,
if not all, of the problems relative to a large repair shop for such equipment.

Description of the Related Art:

25 Dropping off equipment at a dealership or service site for service can be a time
consuming and frustrating activity. Even though such organizations may open as
early as 7 a.m. and stay open until 6 p.m. or so in order to accept equipment for
service, these hours are not always long enough to accommodate all customers.

Consequently, some customers find it necessary to drop off their equipment off during hours that the service centers are closed. With automobiles, for example, the driver usually leaves the automobile keys in an envelope upon which the driver writes observed problems, and requests service of these problems. The envelope is usually
5 then put into a cubicle, which locks on closure. In such instances, the symptom situation is not always communicated effectively. Even when the repair shop is open, the customer may need to wait some time in order to provide the necessary information to a service manager or other representative, thus creating further delays. The above process is improved by using the modern computer technology of this
10 invention.

The present invention provides an interactive, user friendly, symptomatic recording system for the driver or other equipment operator, i.e. the customer. The customer can answer basic menu-driven queries and/or prompts, and the system prepares and transmits to the repair center a preliminary symptomatic report including
15 the symptom or symptoms that prompted the need for repair or service, including the frequency of occurrence of the problem symptoms. For example, problems could be hard starting in the cold, which problem has never happened before. The system of the invention is particularly useful for use outside of the normal operating hours of the repair facility.

20 Representative of the art is;

U S Patent No 5,214,5 82, issued to Gray, teaches interactive diagnostic systems and methods for automotive vehicles of the type having networks of sensors and actuators for sensing and actuating various functions in the vehicle and onboard computers for monitoring sensors and controlling the actuators. An external computer
25 is used to control selected actuators independent of the onboard computer and for simulating operation of selected sensors. At the same time, the electronic data entering and existing the onboard computer is monitored and analyzed by the external computer for trouble shooting purposes.

U.S Patent No. 5,513,107, issued to Gormley of Ford Motor Co., teaches
30 methods and apparatus for controlling operating subsystems of motor vehicles.

Diagnostic maintenance services for the vehicles are provided by monitoring various operating subsystems connected to a vehicle controller and recording diagnostic data. Such data can be periodically communicated to a service center which determines the service(s) needed and communicates their conclusions back to the vehicle controller
5 where it is displayed to the vehicle operator.

U.S. Patent No. 5,557,268, issued to Hughes et al. of Exxon, teaches an automatic vehicle recognition and customer automobile diagnostic system. Each vehicle includes a transponder that transmits a Radio Frequency (RF) code so that vehicle diagnostic measurements made upon entry to the service facility can be
10 associated with the specific vehicle and displayed to the customer in their service area.

U.S. Patent No. 5,058,044, issued to Stewart et al., teaches a system for automatically identifying vehicles assimilating data from the identified vehicle, correlating the data with predetermined data and providing a
15 statement of account for a transaction involving the vehicle. A service record for the vehicle is prepared by the system for use in connection with such transactions. Data for the service record is provided primarily by onboard sensors, but may be augmented by data submitted via an onboard keyboard.

U.S. Patent No. 4,602,127, issued to Neely et al., teaches a vehicle diagnostic
20 system comprising a portable communications control station and a remote data processing station. A portable communications controller is connected to a vehicle data terminal to obtain data from the vehicle's onboard computer.

U.S. Patents Nos. 4,975,847 and 5,065,023, both issued to Abe et al., teach motor vehicle diagnosis systems.

25 U.S. Patent No. 5,541,840, issued to Gurne et al. of Chrysler Corporation, teaches a hand-held automotive diagnostic service tool which can operate with a master station to monitor, display, and process vehicle data and diagnose fault conditions. Service manual pages can be displayed and parts ordered on-line.

U.S. Patent No. 5, 533,093 teaches an automated troubleshooting mechanism incorporated into portable test and communications equipment for telephone lines. Work order manager software is employed.

U.S. Patent No. 4,916,441 teaches a hand-held pocket terminal having a
5 display screen and bar code reader for use in conjunction with patient medical care.

Various aspects of interactive CRT touch panel displays are taught by U.S. Patent Nos. 4,449,186 (to Kelly et al), 5,404,443 (to Hirata), 5,488,575 (to Danielson et al.), 5,499,707 (to Steury) 1 5,537,315 (to Mitcham) and 5,539,429 (to Yano et al.). Such touch panels have been found useful in facilitating communications in a variety
10 of customer service contexts.

The Super Advisor System marketed by Automatic Data Processing, Inc., of Hoffman Estates, Illinois, USA, allows Service advisors to use a hand-held, wireless pen pad computer system to select or decline maintenance items displayed on the computer's screen and to describe vehicular problems via a series of checklists and
15 multiple choice questions The system also provides customer appointment management, etc , using Microsoft Windows.

SUMMARY OF THE INVENTION

One aspect of the present equipment serving invention is to provide an efficient system and process for obtaining, recording and utilizing appropriate
20 information about a vehicle, and why it requires service from a customer, this system including use of the Internet.

In an embodiment of the invention the Internet provides for communication between a plurality of service sites and a plurality of equipment sites at which equipment needing maintenance, repair, periodic
25 service and/or emergency service are operated. Each piece of equipment includes a sensor array and a manual actuator that is activated when an abnormal mode of operation of the equipment is experienced. When the manual actuator on a piece of equipment is actuated, the equipment's

operating conditions, as sensed by the sensor array, are stored in memory. Later, when a request to service the equipment is sent from an equipment site to a service site, using the Internet, the service site queries the equipment site as to equipment symptoms. Upon receiving this query, an operator at the
5 equipment site causes the symptoms stored in memory to be transmitted to the service site, again using the Internet. Based upon the symptoms received at the service site, a service plan for the equipment is formulated.

The invention provides a system for obtaining such symptom information without the need for the presence of a representative of the repair shop.

10 Yet another aspect of the invention is to provide a complete, concise, and readable repair/service order for the mechanics, for parts suppliers, and for the customer.

These and other objectives are fulfilled by a preprogrammed and interactive computer systems for obtaining vehicle information, problem symptoms and a request
15 for service from a customer, and for developing work orders and parts orders based upon the information that was supplied by the customer. The system includes:

Interactive input, display, computing and storage mechanisms for querying the customer, for receiving inputs of information from the customer, and for storing the provided information;

20 A preprogrammed central computer processing unit(s) for ordering successive presentations of appropriate queries for presentation to the customer via the display means;

A compiler to summarize inputs received from the customer, and for processing a summary of a work order and/or a parts order; and at least one
25 printer to print a work order for use by both the customer and a mechanic, to process billing records, and to process reminders relative to vehicle service and relative to future service

Optionally, an input mechanism can be provided to transmit data upon completion of the service work to an accounting module or to a subsystem to facilitate

preparation of a bill for services and a notification to the customer by an accounting department. Such data can also be transmitted to a quality control subsystem.

Further input and display mechanisms are provided for the mechanic, for the service representative, or for the layperson using the system to check
5 and provide status information about the automobile's current service program. A data bank is provided to receive and maintain current status information on work assignments being performed for customers and cars. Interactive communication units are provided to originate and receive calls to
10 and from customers regarding the status of the work assignments on their cars. Interactive communication units are also provided to initiate and execute orders for service, for supplies, and for parts from dealer stock or from external providers.

Other components of the system include interactive computer monitor screens which identify relevant portions of the vehicle, the locations therein, and symptoms.
15 Input mechanisms for the system include touch activating monitor screens and keyboards. A database of scheduled and unscheduled periodic maintenance tasks for various types of vehicles serviced can be linked to the pertinent query screens. This database information can be provided at a geographic distance by use of the Internet or locally through computer memory. Programmed query sets include the categories
20 of engine/drivability, noise/vibrations, transmission, 2 and 4-wheel or more drive, heater/AC, brakes, steering/suspension, power accessories/electrical, and miscellaneous other services.

Further, an interactive computerized process is provided for receiving customer inputs, for compiling and summarizing those inputs, and for developing
25 work orders for service personnel and non-layperson technicians identifying the symptomatic problems that prompted the layperson to seek automobile repair and maintenance. This is accomplished by steps including:

querying the customer and receiving inputs regarding the customer and the automobile ID via computer input and output systems using programmed

sets of questions regarding specified vehicle systems and categories regarding the maintenance and/or repairs;

selecting services which are requested and/or needed, including investigative work;

5 printing, storing and displaying work orders including the provided customer and vehicle ID and assigned services for both the customer and assigned mechanics, and

 printing reminders for use by the equipment owner or by equipment service personnel relative to prior history, dates or usage mileposts requiring
10 further service, or bar-coded information for future reference.

BRIEF DESCRIPTION OF THE DRAWINGS

Like reference characters designated corresponding parts in the several views.

FIG. 1 provides a block diagram of the system as it would be used at a typical automobile dealership or repair shop.

15 FIGS. 2A and 2B are a master flow sheet illustrating the organization and operation of the system.

FIGS. 3A and 3B illustrate a "customer service process" of using the system.

FIGS. 4 through 11 show queries for each of the subcategories of FIGS. 2A-
20 2B.

FIG 4 is a flow sheet for the category 1, "Engine Drivability", problems.

FIG. 5 is a flow sheet for the category 2, "Noises/Vibrations", problems.

FIG. 6 is a typical flow sheet for the category 3, "Automatic/Manual/4-wheel Drive", problems.

FIG. 7 is a flow sheet for category 4, "Heating/AC", problems.

25 FIG. 8 is a flow sheet for category 5, "Brakes", problems.

FIG. 9 is a flow sheet for category 6, "Steering/suspension", problems.

FIG. 10 is a flow sheet for category 7, "Power Accessories/Electrical", problems

FIG. 11 is a flow sheet for the category 8, "Other Services".

5 FIGS. 12A through 21R are illustrative of computer screens useful for obtaining the information needed under categories 1 through 8.

FIGS. 12A through 12G illustrate selected computer monitor screens for "Introductory Information."

10 FIG. 13 illustrates a computer monitor screen for the selection of pertinent categories.

FIGS. 14A through 14D illustrate computer monitor screens for the "subcategory 1" program.

FIGS. 15A through 15E illustrate computer monitor screens for the "subcategory 2" program.

15 FIGS. 16A through 16E illustrate selected computer monitor screens for the "Subcategory 3" program.

FIGS. 17A through 17E illustrate selected computer monitor screens for the subcategory 4" program.

20 FIGS. 18A through 18D illustrate selected computer monitor screens for the "subcategory 5" program.

FIGS. 19A through 19D illustrate selected computer monitor screens for the "subcategory 6" program.

FIGS. 21 A through 21S illustrate selected computer screens for the "subcategory 8" program.

FIGS. 22A through 22C illustrate selected computer screens for the "Additional Services" program.

FIG. 23 illustrates a computer screen for addressing "Additional Problems."

FIG. 24 illustrates a screen for "Unscheduled Services."

5 FIGS. 25A and 25b illustrate screens asking for a review the "Repair Order."

FIG. 26 illustrates an "Estimated Repair Costs" screen.

FIG. 27 illustrates a "Designation of the Service Advisor and Cost Estimate" screen.

10 FIG. 28 illustrates a screen authorizing repair work and acknowledges criteria under which the repair is to be done

FIG. 29 is illustrative of a screen providing instructions for the deposition of keys into a lockbox.

FIG. 30 illustrates a screen allowing a designation of whether the customer wishes to "Wait, Drop off the Car, or obtain a Loaner."

15 FIGS. 31 A and 31 B illustrate screens relating to the acceptance of the finished repair order.

FIGS. 32A and 32B depict a representative print out of "Repair Order."

FIG. 33 is a portion of a typical flow sheet for the repair of other vehicles and equipment.

20 FIG. 34 shows the use of the Internet to communicated between service sites and remote sites at which owners of equipment to be serviced are located.

FIG. 35 shows an automobile having a sensor array, a manually operable button that is to be activated when an abnormal mode of operation of

the automobile is experienced, whereupon all sensed operating conditions of the automobile are recorded in memory, for later transmission to a selected service site.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

5 FIGS. 1 and 2 provide an overview of the systems and methods of the invention. FIG. 1 is a system overview of the invention. A customer brings an automobile to a repair center where the customer interacts with a customer interview terminal screen 10.

Console 10 can include a portable personal computer or, at least, a
10 freestanding terminal serving a master computer. Console 10 comprises input means and interactive display means, such as a touch-active CRT screen such as disclosed in U.S. Patents Nos. 4,449,186, 5,404,443, 5,488,575; 5,499,707; 5,537,315, and 5,539,429 incorporated herein by reference. Such touch-active screens may incorporate audio output means, as disclosed in U.S. Patent No.
15 4,449,186. The system of the invention is designed so that hardware and software cooperate to provide convenient means for the customer to provide the necessary symptomatic information to facilitate service/repair. In the embodiment using a touch active CRT screen, most information is provided via the touch-active screen in response to a menu-driven series of queries or
20 prompts. Some of the input information (i.e., vehicle ID, customer ID, credit card payment information, and the like) can be provided by inserting into a card reader 20 a credit card or other identity card issued by the repair center to minimize effort on the part of the customer, and to minimize errors as well. Such cards can be used to unlock and provide access to console 10 and other
25 input devices to minimize vandalism or other unauthorized activities. Alternatively, systems can be used which automatically sense the vehicle ID and/or the condition of the vehicle systems such as; for example, an optical/magnetic reader 40, see *e.g.*, U.S. Patent No. 5,058,044. To augment the touch-active screens, a standard or simplified alphanumeric keyboard 30

can be provided, and optionally provisions can be made for the customer to dictate into the input system using devices such as the voice-activated system disclosed in U.S. Patent no. 5,586,037.

In addition to the customer direct input of ID data, observed symptoms, and requests at this intake transaction, the customer may be assisted by a service advisor or by other representatives of the repair center. Such representatives may enter information at console 10, and/or use a hand-held device such as disclosed above. Optionally, readings may be taken from the vehicle onboard computer 50 at this point using a hand-held unit or other computerized monitor. In this way, error codes from the onboard computer can be read, analyzed, and considered in writing up a vehicle service order. This mode of operation will normally be available only if the customer is willing to wait and if there is a repair center representative available to take the readings, unless an automatic sensor system is used as in U.S. Patent No. 5,557,268. A service advisor may introduce information into the system via console 10, either during the customer intake transaction or thereafter. Preferably, the service advisor will employ a hand-held unit incorporating the functions of console 10.

Console 10 displays menus, queries, prompts and input/output data on a CRT screen, and upon command, or upon completion of the transaction, a printer 90 prints out materials, or other similar printers 90 can be attached to the system by way of input devices or networked to computing device 70 for the customer's use.

The information inputs all enter computing device 70 that could include a programmed computer, as shown, having a Central Processing Unit (CPU), a device having firmware embedded into microchips, a general personal computer having specialized application programming. The information entered into computing device 70 is analyzed, summarized, compiled, and correlated. The system may query the customer further to fully develop the input information before closing the transaction. When the initial information is obtained, the system prepares a service order that includes a standardized reporting of the symptomatic problems that prompted the lay person to seek repairs of the vehicle. The present invention can be combined with a

diagnostic service program that outputs service needs when the needed service and/or repairs are clear. More typically; however, more information is needed to determine the service required; therefore, the system can print out and display a standardized summary of the symptomatic problems containing queries for the mechanic and/or service advisor to analyze. The service mission is subject to change after readings have been taken from the vehicle onboard computer.

A finished service order will be transmitted to mechanic, service representative, technician or other professional via printer 90 and/or console 10, which displays the order on a CRT screen. Using similar input means to those described for console 10, the mechanic can submit information to modify the service order, query the service advisor as to what work is approved, and advise the system when the job is completed or delayed. Such inputs are transmitted to computing device 70, which then stores and processes the inputs. Events including job completion or delay are transmitted via suitable communications media, such as a telephone, facsimile, or e-mail, to the customer using customer notification programs. Additionally, in the process of the service/repair job, computing device 70 can be used to optionally identify and order materials, spare parts and the like for the service/repair using an ordering program.

FIGS. 2A and 2B show a master flow sheet illustrating the operation of the computerized process outlined in FIG. 1. To initiate the intake process, a customer approaches terminal 100. Information input can be by scanner, *e.g.*, FIGS. 12A and 12B, or other means, *e.g.*, a typewriter. Preferably, the information is generally input using a touch screen. Where a numeric input is needed, a keypad will be provided, *e.g.*, 12A and 12B. Where alphabetic and numeric information is needed, an alphanumeric keypad will be provided, *e.g.*, FIG. 12C. Specific information is input into the computer of a preferred hand-held unit by stylus pressure on a square, *e.g.*, FIG. 13; a dot or a circle, *e.g.*, FIG. 14C. Basic ID, and, where selected, credit card information can be provided via an ID card reader 105 and/or submitted via touch-active screen or keyboard. The information provided appears on display 110 which provides correction prompts or queries. For example, if the current vehicle mileage

and phone contact information are not provided initially, they can be submitted upon request as at steps 115 and 120. When the necessary, intake information is provided, the display shifts to a main menu 125 which offers multiple choices as well as a "Help" function. In FIG. 2, main menu categories include the Engine/drivability (1), Noise/vibrations (2), Automatic/manual/4wheel Drive Transmission (3), Heater/AC (4), Brakes (5), Steering/suspension (6) Power accessories/electrical (7), and Other services (8) subcategories. These categories are supplemented (See Fig. 33) for vehicles that are more complex than automobiles, e.g., a Peterbilt truck, and vehicle-based equipment, e.g., a cherry picker and a front loader. Each of these menu choices leads to subroutines containing multiple menu choices to guide the customer through an interrogation process which identifies symptomatic problems to be corrected and/or routine services to be performed. Exemplary flow diagrams for these subcategories are provided in subsequent figures discussed below. Upon completion of any of the subroutines 1 through 8, the display shifts to a "General Questions" subroutine 130 which queries the customer as to how often the problem(s) occurred and similar questions. After responding to these queries, the customer is queried at step 135 to determine if there are additional vehicle problems; if "yes", the program reverts to the main menu for further choices. Selection of "other services" menu 140 provides options for choosing various maintenance services as well as a "Help" option which refers the customer to a service advisor as shown at 145.

Upon completion of the interrogation via the categorical subroutines, the customer is automatically transferred to "Additional Services" subroutine 150, which offers further choices discussed below for routine service operations and the like. Once the customer exits this menu, the customer is transferred to subroutine 155 which uses Boolean and other processing logic to provide a compilation of the symptoms and of requested service items and displays the compilation along with a menu of additional accessories or services which can be purchased. Following this, subroutine 160 provides a cost estimate of any requested maintenance services, and subroutine 165 provides a cost estimate of repair costs and pickup time. The repair/work order is presented by subroutine 170, and the customer's electronic

signature is then captured. On signature of the repair order, instructions for leaving the key(s) in a secure depository are shown at 173. Subroutine 175 then queries whether the customer will wait for the vehicle, drop it off, or request a loaner vehicle. Subroutine 175 also queries the customer's requests with regard to the disposition of the used parts. Finally, at step 180 the finished repair estimate is displayed and printed out for the customer, for the service advisor and for the mechanic, technician or other professional service provider.

FIGS. 3A and 3B illustrate a customer's interaction with the system. As in FIG. 2, a customer interacts with blocks 300, 305, 310, 315, 320, and is then transferred to main menu 325. Category 1, engine/drivability, is selected by the customer at 330 and menus are presented as in FIG. 4. The customer is exposed to a succession of computer monitor screens in the course of selecting from the menu, as is illustrated in FIGS. 12A through 12G.

As shown in FIG. 3, the customer selects the "symptoms when starting" category at 335, and thereafter is called upon to describe the symptoms at 340 and when they occur at 345. After selection of the latter, the system transfers to the "General questions" subroutine at 350. After this question is answered, the system transfers to the "Additional vehicle problems" subroutine at 355. In this case, the customer selects "NO," and is transferred to the "additional services" menu at 360. Since the customer chose no additional services at 355, the system compiles and summarizes the symptoms and any requested maintenance services at 365 and presents the customer with a menu of additional merchandise and services which can be purchased. Subroutine 370 presents the customer with the estimated maintenance costs (if any), and subroutine 375 presents a statement of estimated repair costs and pickup time. The system then captures the customer's signature at 380, queries as to whether customer will wait or drop off the vehicle with the repair organization, whether a loaner is required, and whether parts are to be returned as shown in block 385. Finally, the finished repair order is displayed and printed for both the customer and the mechanic at 390. The system then resets for the next customer at 395.

FIG 4 illustrates the operation of the "engine/drivability" menu (category 1). The customer is initially presented with a choice as to describing symptoms which occur when starting or driving, or "other symptoms". Given any of these three choices, the customer is asked to describe the nature of the symptoms and to describe
5 when the symptoms occurred. Optionally, inputs from the service computer 101 of FIG. 35 can be provided at this point to provide further information on the nature of the symptoms and when they occurred. After these questions are answered, the FIG. 4 subroutine transitions to a "General Questions" subroutine to describe how often the symptoms occurred. From the General Questions subroutine, the customer selects
10 whether or not there are Additional Vehicle Problems. If none, the customer proceeds to Additional Services; if "yes" is answered, the customer is returned to the Main Menu to make another choice.

FIG. 5 illustrates menu choices for "noise/vibrations" (Category 2). The initial menu allows the customer to select noises or vibrations alone or a combination of
15 both. Whatever the choice, the customer is then queried as to what the nature of the symptoms are, when they occurred, and where the symptom occurred. Input from FIG. 35 service computer 101 can be provided to assist in the analysis. Finally, the customer is queried as to "how often" the symptoms occurred. At this point, the computer advances to "Additional Vehicles Problems" at 135.

20 FIG. 6. illustrates menu choices for a "automatic/manual/4-wheel drive" transmission check (Category 3). The initial menu requires selection as to automatic or manual transmissions or 4-wheel drive. Once a selection is made the customer is queried as to the nature of the symptoms and when they occurred. After these questions are answered, the customer is queried as to how often the symptoms
25 occurred. After all of these questions have been answered for a subcategory, the customer is queried as to whether there are problems in another subcategory. If not, the system moves to a closing sequence. If the customer indicates that there are problems in another subcategory, (e.g., problems with the 4-wheel drive in addition to the transmission), the computer returns to the main menu at 125 for another selection.

FIG 7 illustrates the operation of the menu for "Heating/Air Conditioning" (Category 4). The initial menu selections are for symptoms of heating, air conditioning or automatic temperature control. Once a subcategory is selected, the customer is again called upon to describe the nature of the symptoms and when they occurred. With these questions answered, the system transitions to "General Questions", including how often the symptoms occurred. After these questions are answered, the customer is called upon to declare whether there are additional problems in other subcategories. If not, the closing sequence is actuated. If yes, the customer is returned to the menu at 125 to make another selection.

FIG. 8 illustrates the menu choices for "Brakes" (Category 5). The initial menu selections are for conventional brakes, anti-lock brake systems, or combinations of both. As in the other categories, the customer is called upon to describe the nature of the symptoms, when they occurred, and how often they occurred, before returning to the main menu or before going through the closing sequence.

FIG. 9 illustrates the menu choices for "Steering/Suspension" (Category 6). The initial menu choices are for steering or suspension problems, and after making a selection, the customer is called upon to describe the nature of the symptoms, when they occurred, and how often they occurred. After these questions are answered, the customer is queried whether there are any symptoms in any other subcategory (e.g., suspension in addition to steering). The customer is then returned to the main menu or the customer is passed through the closing sequence.

FIG. 10 illustrates the menu choices for "Power Accessories/Electrical" (Category 7). The initial menu choices are for electrically operated components and power accessories, and once a selection is made, the customer is queried as to the nature of the symptoms, when they occurred, and where they occurred. Once these questions are answered, the customer is queried as to how often the symptoms occurred. Upon completion of these questions, the customer is queried as to whether symptoms exist in another subcategory. If not, the customer is presented with the closing sequence.

FIG. 11 illustrates the menu operation for "Other" problems (Category 8). The initial menu choices are scheduled and unscheduled maintenance, i.e. maintenance which is conducted at predetermined total mileage figures or at periodic mileage/time intervals. Once selections are made for any required maintenance in these subcategories, the system queries the customer regarding "Additional Vehicle Problems". Subcategories 3 and 4 provide menu choices regarding problems with the vehicle's exterior and interior. Having selected one of these subcategories, the customer is queried as to the nature of the symptoms, when they occurred and where they occurred, before being asked general questions including how often they occurred. When queries and answers for each subcategory are completed, the customer is queried as to whether problems/symptoms exist in other subcategories. If so, customer is returned to the main menu for another selection. If no, the customer progresses through closing sequence. Subcategory 5 covers special orders or parts and recall notice items. Subcategory 6 deals with new or used car problems. In subcategory 7, "General Symptoms", the customer is again called upon to describe the nature of the symptom, when they occurred, where they occurred then how often the symptom occurred.

FIGS 12A and 12B illustrate computer screens which relate to information obtained by optic, magnetic or RF (including microwave) scanning. As shown in FIGS. 12B and 12C, information also may be input through touch screen technology or other input menus, not specifically shown. FIGS. 12C through 12D illustrate screens which enable the customer to input personal information. FIGS. 12E and 12F are illustrative of screens enabling the customer to input "Mileage" by pressing a "change" designator to bring up a numeric keypad. FIG. 12G similarly enables the customer to enter a telephone number for use in telephone contact during the period that the automobile is in the service/repair shop. An illustrative keypad screen is omitted.

FIG. 13 illustrates a screen used for the selection of one or more repair categories. Category 1, "Engine/Drivability" has been selected as indicated by the outline around that category.

FIGS. 14A through 14D illustrate computer monitor screens for the "Category I" program. FIG. 14A identifies the category and asks for the selection of "Symptoms". FIG. 14B illustrates a screen for "Symptoms when starting". FIG. 14C illustrates a screen for "When do you notice it", i.e., questions about the nature and frequency of the symptoms. FIG. 14D illustrates a screen querying the customer regarding "Symptoms when driving".

FIGS. 15A through 15E illustrate selected computer monitor screens for "Noises and Vibrations", the Category 2 program. FIG. 15A illustrates a computer screen representing the selection of the "Noise or Vibration" category, including selections for noises and/or vibrations. FIG. 15B illustrates a screen representing the selection of the "Noise information" subcategory. FIG. 15C illustrates the screen presenting the query "Where is it coming from?" via diagrams of an automobile. FIG. 15D illustrates a screen querying "When does it happen" containing generic questions pertaining to noises and/or vibrations. FIG. 15E illustrates the screen requiring the selection of vibrational categories wherein "Shudder" has been selected.

FIGS. 16A through 16E illustrate selected computer monitor screens for a Category 3, "Automatic/Manual/4-wheel Drive Transmission" program.

FIG. 16A illustrates the computer screen for the category of "Transmission" information, offering choices for automatic or manual transmissions or an exemplary 4-wheel drive. FIG. 16B illustrates a screen for the "Automatic transmission" subcategory offering choices as to types of symptoms observed. FIG. 16C illustrates a screen for the "Manual transmission" subcategory, offering choices of various symptoms observed. FIG. 16D illustrates a screen for the "4-wheel drive transmissions" subcategory, offering choices as to various symptoms observed. FIG. 16E illustrates a screen querying "When does it happen", with a set of generic questions that are applicable to any of the subcategories.

FIGS. 17A through 17E illustrate selected computer monitor screens for the category 4, "Heater/AC" program. FIG. 17A illustrates a computer screen for defining the Heating or Air Conditioning problem. FIG. 17B illustrates a screen for

the "Heating" category. FIG. 17C illustrates a screen for the "Air Conditioning" category. FIG. 17D illustrates a screen for the automatic temperature control system. FIG. 17E illustrates a screen providing questions as to "When does it happen."

FIGS. 18A through 18D illustrate selected computer monitor screens for the category 5 "Brakes" program. FIG. 18A illustrates a computer screen for defining the particular brake system. FIG. 18B illustrates a screen for defining one or more problems with a conventional braking system. FIG. 18C illustrates a screen for defining one or more problems with regard to anti-lock braking system. FIG. 18D illustrates a screen querying "When does it happen."

FIGS 19A through 19D illustrate selected computer monitor screens for the category 6, "Steering and Suspension" program. FIG. 19A illustrates a computer screen for defining whether the problem relates to steering or to suspension. FIG. 19B illustrates a screen for the "Steering information" subcategory, including questions regarding various symptoms observed with regard to the steering. FIG. 19C illustrates a screen for the "suspension" subcategory, including questions regarding various symptoms that were observed. FIG. 19D illustrates a screen querying "When does it happen", including questions regarding the operating modes and speed when either steering or suspension symptoms occur

FIGS. 20A through 20F illustrate selected computer monitor screens for the "Electrical" program. FIG. 20A illustrates a computer screen offering choices of problems connected with "electrically operated components" or "power accessories". FIG. 20B illustrates a screen which includes questions regarding specific components requiring service. FIG. 20C illustrates a screen including questions regarding "Power accessories" where problem symptoms were observed. FIG. 20D illustrates a screen for narrowing the problem terms. FIG. 20E illustrates a screen for a "When does it happen" query. FIG. 20F illustrates a screen for identifying an area of the automobile where the problem is believed to be located.

FIGS 21A through 21S illustrate selected computer screens for the "Other services" category. FIG. 21A illustrates a screen for "Other services available"

offering menu choices for scheduled and unscheduled maintenance, vehicle exterior and interior, special order parts and recall notices, new or used car internal and general symptoms. FIG. 21B illustrates a screen for "Scheduled Maintenance" and FIG. 21C illustrates a screen for "Unscheduled Maintenance". FIG. 21D illustrates a screen for the "Vehicle exterior" subcategory including questions regarding the area(s) in which the problem is occurring. FIGS. 21E through 21I provide problem location selections. FIG. 21E illustrates a screen requesting information on the problem location. FIG. 21F illustrates a screen for locating a problem on the vehicle's exterior via a diagram. FIG. 21G illustrates a computer screen for the "Vehicle interior" subcategory, including questions regarding the area where the problem occurred. FIG. 21H illustrates a screen for the "Problem location" subcategory of "Vehicle interior lighting". FIG. 21I illustrates a screen for locating problems via a diagram. FIG. 21J illustrates a screen for describing the problem. FIG. 21K illustrates a screen for providing information regarding a special order or recall notice. FIG. 21L illustrates a screen for a "new car" or a "used car" internal repair order. FIGS. 21M through 21S illustrate screens for identifying things the customer sees, hears, smells and feels under the "help" category 140 of FIG. 2 and asks "When" and "Where."

FIGS. 22A through 22D illustrate selected computer screens for "General Questions, Other Symptoms and Return Problems."

FIG. 23 illustrates an "Additional problems" screen.

FIG. 24 illustrates a screen for selecting "Unscheduled services" and includes prices for those services.

FIGS. 25A and 25B are screens requesting that the customer review the previously input material.

FIGS. 26 and 27 illustrate screens for providing an estimate of cost and pick up time.

FIG. 28 illustrates a screen for acknowledgement and capture of customer signature. This corresponds to block 170 of FIG. 2.

FIG. 29 illustrates a screen instructing the customer to deposit the vehicle keys in an appropriate lockbox.

5 FIG. 30 illustrates a screen for selection of "wait", "drop off", or a "loaner."

FIGS. 31A and 31B illustrate "Repair order acceptance" screens. This corresponds to block 180 of FIG. 2.

FIG. 32 illustrates a "Repair order generated" screen, including the captured customer signature.

10 FIG. 33 illustrates the additional categories 9 and 10 of a Master Flow Sheet extending FIG. 2 for various types of vehicular equipment.

Various combinations of commercially available computer hardware can be used to assemble the system of the invention. Computer support can range from a single personal computer or a microcomputer to a master computer with multiple terminals. Portable or hand-held terminals or computers can be used to facilitate the collection and transmission of data. The computer support mechanisms preferably include a central processing unit, at least one compiler, data storage devices including disk drives and the like, at least one monitor with a display screen, a modem, an interactive media device and input/output mechanisms. The computer system is configured, as required, by the particular programs to be run with capacities and rates suitable to provide reasonable response times.

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Input mechanisms can include conventional keyboards and/or keypads, interactive touch screens, and screens with icons, such a graphical user interfaces, that are responsive to manual input, devices, such as a "mouse," optical and magnetic readers, and data input ports. Preferably, the input mechanisms include touch-active display screens. Such screens permit interaction between a user and the computer in response to the user touching the screen with an object such as a finger or a pointing

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device. As disclosed in U.S. Patent No. 5,537,315, such pointing devices can include a light pen, sonic pen, voltage pencil, stick, or wand. Other input mechanisms to the system, if not directly to the computer, may include smart card devices, such as conventional credit card readers, for receiving data about the customer and/or about the vehicle to be serviced, plus payment information such as credit card numbers. One suitable credit card reader is disclosed in U.S. Patent No. 4,449,186, column 1.

Optionally, the input mechanisms can include a voice-activated system, such as a digitized voice recognition system for receiving user input, such as those pioneered by Dragon Systems, Inc., San Rafael, California.

10 The computer support mechanisms preferably include at least one hand-held or portable terminal which permits data to be input to the system via a keypad or keyboard or an equivalent device. This permits a service advisor and/or a mechanic to receive data and to input data conveniently from the vehicle. Such terminals have become commonly available and can be designed or purchased and modified to interface with the system. A representative example of such terminals is found in U.S. Patent No. 5,468,575.

Because most contemporary automotive vehicles include onboard computers which receive information from sensors, control various systems via actuators, and record various failures of equipment, input mechanisms for the system include mechanisms for reading and analyzing data from such onboard computers. Any suitable mechanism can be used which allows such data to be read, analyzed, and input to the computer or to the system. One example is the "hand-held automotive diagnostic service tool", of U.S. Patent No. 5,541,840, which is incorporated herein by reference. As disclosed in U.S. Patent No. 4,602,127, many modern vehicles include mechanisms for obtaining direct access to the data of such onboard computers on a real-time basis. Inputs to the system can also be provided by automatic vehicle recognition and diagnostic systems such as those disclosed in U.S. Patent No. 5,557,268.

Output mechanisms can include display mechanisms, such as CRT display screens of computer monitors, printers, and program-actuated facsimile, credit

checking devices, and/or telephone devices. The printer(s) can be any suitable unit(s) selected from commercially available models, such as laser or ink jet printers.

Computer programs or software subsystems or modules are used to carry out various tasks for which the systems are employed. Many of these subsystems can be obtained or modified from existing commercial programs. In any case, the required programs can readily be provided by those of ordinary skill in the art in view of the teachings herein. For instance, accounting and billing programs are readily available and can be obtained or modified to provide a statement of account for services performed. Programs for receiving and analyzing the data stored in vehicle onboard computers are also available. However, the most important part of the diagnostic process will still generally be the analysis by the mechanic and/or service manager of the information provided by such programs and the vehicle's driver. Service order writing programs are generally available; see, e.g., U.S. Patent No. 5,058,044.

Programs to generate and/or to access a service record for the vehicle(s) being serviced are also available. Technical library or database programs can be used to provide access to scheduled and unscheduled maintenance operations, service and parts manuals for the mechanic as well as for the customer. Programs for identifying and ordering parts are also available. However, such programs will generally be tailored or prepared especially for users of the particular systems of the invention.

The figures provide an exemplary mechanism for obtaining the vehicle driver's input. They do not include a listing of all possible options with respect to automobiles. Additional categories 9 for "Mechanical" systems and 10 for "Hydraulic or Pneumatic" systems include the "What", "Where", and "When" questions of the previous categories, and will provide feedback subroutines necessary to handle vehicles other than automobiles and mechanical equipment for grading, lifting, moving, etc., various items and/or products.

FIG. 34 shows a feature of the invention whereby a plurality N of geographically spaced remote sites and a plurality of geographically spaced service sites are enabled to bi-directionally communicate through the use of the well-known Internet, as is above-described in accordance with the invention.

Each individual remote site is designated as a remote site 1 through a remote site N, and each individual service site is designated as a service site 1 through a service site M. Each of the remote sites 1 through N can, for example, comprise a personal computer (PC) that is located within the home of an individual equipment or automobile owner, whereas each service site 1 M may comprise a PC that is located within the service facility of an equipment repair company, such as the repair department of a automobile dealership.

Each one of the individual service sites 1 through M provides for its own web site within the Internet, these individual web sites being designated web site 1 through web site M, wherein web site 1 corresponds to service site 1, etc.

Computing equipment at each of the customer sites (i.e. remote sites) and at each of the service sites enables bi-directional communication between the customer sites and the service sites by way of the Internet.

Each of the web sites 1 through M is constructed and arranged to enable any given customer site 1 through N to input information relative to a piece of equipment or automobile that is to be serviced, as is described above.

In some cases, a given service site may provide service for only one type of equipment. In other cases, a given service site may provide service for a number of types of equipment, for example a number of different brands of automobile. In this later case, that service site's web site is constructed and arranged to enable a customer site to initially make a selection as to the particular type/brand of equipment that is to be serviced, this being followed by the inputting of information in accordance with the invention and as described above, relative to the particular type/brand of equipment that is to be serviced.

For example, should the automobile owner at remote site 3 desire to have his/her brand X automobile serviced by service site 5, this owner uses a PC, perhaps at his/her home, to access web site 5. If service site 5 services more that one brand of automobile, the owner at customer site 3 now accesses that portion of web site 5 that is associated with the brand X automobile. Thereafter, the owner at customer site 3 inputs information as above described relative to the service that is needed and/or relative to unusual

operating symptoms that the owner has experienced relative to his/her particular brand X automobile.

The brand X owner may propose a time/date at which this particular automobile will be brought to service site 5 for service. Upon receipt of this
5 Internet communication from remote site 3, service site 5 responds by sending a confirmation of service message, perhaps proposing a different time/date. Thus, by way of a two-way Internet communication between remote site 3 and service site 5, an agreement is reached that facilitates the servicing of this particular brand X automobile by service site 5.

10 FIG. 35 shows a feature of the invention whereby a snap shot of the operating state of a piece of equipment is instantaneously captured, for later use in defining the operating parameters of the equipment as they existed at the time that the operator of the equipment experienced an unusual mode of operation of the equipment, this unusual mode of operation perhaps indicating the need to service the equipment.
15 While this feature of the invention will be described relative to an automobile, the spirit and scope of this feature of the invention is not to be limited thereto. The snap snot of operating conditions allows a service technician to duplicate the symptom as well as the operating conditions that caused the symptom to aid in the repair.

In FIG 35, dotted outline 100 designates a piece of equipment, such as
20 an automobile, that contains a computer chip 101, a sensor array 102, non-volatile memory 103, a first network 104 whose activation enables computer chip 101 to instantaneously read the state of sensor array 102 and to store the content of sensor array 102 within non-volatile memory 103, a second network 105 whose activation enables computer chip 101 to read out the
25 content of non-volatile memory 103, a first manually operable button 106 that activates first network 104, and perhaps a second manually operable button 107 that enables second network 105.

Sensor array 102 could comprise a large number of individual sensors or one sensor, the detail of which is not critical to the invention. It suffices to
30 say that sensor array 102 is operable to monitor the instantaneous state of operation of at least one operating parameter of automobile 100.

More generally, sensor array 102 monitors the operation of a number of automobile components, and the state of a number of operating conditions of the automobile, which components/conditions may generate symptom-related outputs that are of interest to service personnel when analyzing symptoms, and thereafter determining procedures for servicing the automobile.

By way of non-limiting examples, sensor array 102 may monitor tire pressure, vehicle speed, engine revolutions (RPM), engine temperature, engine oil pressure, hydraulic steering/brake/transmission pressures, automobile vibration, the angle of front wheel turning, air conditioner on or off, heater on or off, brakes applied or not applied, various electrical accessories on or off, automobile noise level, convertible top up or down, and the transmission range that is currently operative to apply engine power to the drive wheels.

When the operator of automobile 100 experiences (*i.e.*, senses) an abnormal mode of operation of the automobile, the operator manually actuates button 106 that is mounted, for example, on the steering wheel of the automobile. This action by the operator enables network 104 whereby computer chip 101 is commanded to read-out sensor array 102 and to store the content of sensor array 102 in non-volatile memory 103.

Later, when requesting service of automobile 100, the owner connects computer chip 101 to the service cite, and in response to a symptom query from the service site, the stored symptom content of memory 103 is presented to the service site. When that owner's automobile 100 is located at a remote site, the content of memory 103 is presented to the remote site by using a cable 108, or other equivalent communication link, (including wireless protocols) to connect computer chip 101 to the remote site, whereupon the stored symptom content of memory 103 is presented to the service site by way of the Internet

When communication involves using the Internet, the owner accesses a desired web site, as above described relative to FIG. 34. Later, when the

owner reaches the appropriate web site screen wherein the operating parameters or operating symptoms of the automobile are requested, the owner actuates button 107 (which may be located within automobile 100 or which may be located at the remote site), whereupon computer chip 101 reads out
5 the content of non-volatile memory 103 to the Internet and to the desired web site and service site.

While the two actuating means 106 and 107 have been described as manually operable means, the spirit and scope of the invention includes the use of other equivalent actuating means, non-limiting examples of which
10 include voice responsive actuating means and radio frequency actuating means.

In addition, while the manner of communicating the content of memory 103 to a remote site has been described as using a cable 108, the spirit and scope of the invention includes the use of other equivalent communicating
15 means, a non-limiting example is a RF communicating means.

After the stored symptom content of memory 103 has been presented to the service site, memory 103 is erased to prepare for another occasion of use in response to the occurrence of an abnormal mode(s) of operation of automobile 100

20 What is claimed is.